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NON-LINEAR PANEL ESTIMATION OF TIME-VARYING EFFECTS OF IMPORT QUOTAS

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Key words: NTB, ICLS, quadrature, quotas, ATC, MFA, MPEC, gravity model

Non-linear panel estimation of time-varying effects of import quotas *

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We develop a panel-based ICLS framework for estimating the export tax equivalent (ETE) of quotas where the ETEs vary over time. Working with a panel of bilateral data on textile and clothing trade, underlying bilateral tariffs, and the country-pair coverage of quotas under the WTO's Agreement on Textiles and Clothing (ATC), we use this framework to examine the evolution of market access conditions in the textile and clothing sectors. Our estimating framework takes advantage of the panel nature of trade data when calculating export tax equivalents while allowing for inequality constraints on the quota premium estimates. We also implement quadrature methods for calculating confidence intervals for our regression-based NTB measures.

Keywords: NTB, ICLS, quadrature, quotas, ATC, MFA, MPEC, gravity model

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1 Introduction

Since the inception of the GATT system in 1947, the multilateral trading system has seen quotas imposed on products ranging from cheese and butter to high definition televisions, steel, and motor vehicles. Such quantitative restrictions on international trade flows, and more broadly speaking the entire class of non-tariff barriers (NTBs), have proven an important feature of the policy landscape. For this reason, estimates of the trade cost-equivalents of NTBs are critical inputs to the assessment of the welfare impact of trade policy, as well as to actual trade negotiations. They also influence the trade patterns at the core of the raft of recent econometric work based on the gravity model. (Anderson and van Wincoop 2003, 2004).

In recent history, the launching of the World Trade Organization brought with it the dismantling of the single biggest system of quota restrictions to emerge as part of the GATT-based trading system – an elaborate system of bilateral quotas on textiles and clothing trade. (See Table 1 for a brief overview of this history). The process of dismantling these quotas under the ATC (Agreement on Textiles and Clothing) was staged over a 10 year period ending in 2005. The quotas generated hundreds of billions of dollars in quota rents over the ten-year life of the ATC (and hundreds of billions of dollars more in the prior decades under the Multifibre Arrangement, MFA).

In this paper, we develop a panel-based estimator for the trade cost equivalent of quotas, using importer-exporter-pair departures from gravity-based trade flows over time to estimate the time-path of the export tax equivalent of quotas. We apply this method to the ATC quota phasout.[1] The ATC quota regime offers an appealing testing ground for estimating the time path of NTBs. This is because the quotas were expanded and eliminated in structured stages under the ATC over a defined period of time, and because they involved a large number of importers and exporters. While by construction the quotas were increased over time, our results confirm the casual empirical observation that the technical liberalization of a quota does not guarantee de-facto relaxation of implicit trade barriers when the external environment is also changing. In the case of China, quotas clearly grew at a rate unable to keep up with the rapid expansion of potential trade due to both underlying supply and demand growth. Thus, our estimates provide important policy lessons as well.

Because we work with a panel, there are years where quotas governing bilateral trade pairs switch from being binding to not binding, and vice-versa. Estimating quota rents econometrically is therefore complicated by the need to distinguish situations where quotas bind from those where they do not. In addition, as long as some quotas are binding, regressing output on price variables (like tariffs) will result in a downward biased price coefficient because there is no price response for some country pairs. Furthermore, where the quota is binding one must explicitly ensure that the quota always reduces imports and never increases imports. This points to a need for estimation methods that allow for inequality constraints and avoid poten-

[1]The literature on estimating the impact of NTBs has largely followed one of three approaches. The one we build on here is econometric, involving estimating the price effects using residual-based methods (Leamer 1990, Harrigan 1993, Rose 2002, Mayer 2003, Nicita and Olarreaga 2007). A second approach involves examination of auction prices (Mlachila and Yang 2004; Andriamananjara et al 2004). A third approach involves direct price comparisons (Cahill and Legg 1990; Tyers and Anderson 1992). Also see Rose (2004) for a detailed discussion of the related question of measuring general trade openness.

tial bias in price elasticities. We address these issues, while also using quadrature for assessing the robustness of our estimates. Hence, our approach collectively corrects several potential shortcomings in econometrically-based estimates of the price impact of quota restrictions in international trade – including reliance on point estimates, the need for inequality constraints, and correction for an estimation bias linked to price elasticities.[2]

The paper is organized as follows. In Section 2 we provide brief institutional background on the ATC. In Section 3 we develop our estimating framework. We apply the framework to textiles and clothing trade in Section 4. We provide a summary and closing comments in Section 5.

2 Background

The Ministerial Declaration at Punta Del Este in 1986 that launched the Uruguay Round stated that the "Negotiations in the area of textiles and clothing shall aim to formulate modalities that would permit the eventual integration of this sector into GATT on the basis of strengthened GATT rules and disciplines." In plain English, this was a promise to developing countries that MFA quotas were finally going to be eliminated. Indeed, this promise was critical to convincing developing

[2] In a related paper, Trefler (1993) also confronts the issue of inequality constraints when examining the joint dependence of NTB levels (measured as coverage ratios) and import penetration rates. As he works with the joint determination of trade and protection ratios, which by definition are bound at zero, Trefler uses a simultaneous Tobit estimator. Rose (2002) uses average residuals across a panel, essentially treating country fixed-effect terms in the panel as measures of average openness. One could apply the same approach to country-pair terms. In contrast, we essentially add a time dimension to the evolution of country-pair effects through an inequality constrained n-degree polynomial.

countries to sign on at the creation of the then new World Trade Organization (WTO). The Uruguay Round of GATT negotiations launched at Punta Del Este led to the Agreement on Textiles and Clothing (ATC) in 1995, the institutional shape given to the promise to end quotas in an orderly process.

The ATC was flagged as a major showpiece in the Uruguay Round Agreements, and an important source of trade-based income gains linked to the introduction of the World Trade Organization (WTO).[3] By design, the agreement mapped a gradual phase-out of the quota restrictions carried over from the MFA regime on a ten-year timetable leading to full elimination. [4] Given its clear rules and the following removal of quota restrictions, the ATC serves as a natural experiment to test for the economic impact of quantitative constraints over time.

[3]See Harrison, Rutherford, and Tarr (1995); Francois, McDonald, and Nordstrom (1995); Hertel et al (1995).

[4]The integration of the products covered by the agreement was to be achieved in three stages under a ten-year transition period. The first stage called for the integration of products comprising not less than 16 percent of the total volume of each member's 1990 imports of the products listed in the annex to the Agreement. The second stage, beginning in year 4, required the integration of a further 17 percent. The third stage, beginning in year 8, required that another 18 percent of imports be brought under normal GATT rules. Furthermore, each importing country was free to choose the products it would integrate at each stage, the only constraint being that they had to encompass products from each of the four groupings: tops and yarn, fabrics, made-up textile products, and clothing. Products that remained restricted during the transition period were to benefit from a progressively increasing quota. The previously applied MFA quota annual growth rates were to be scaled up by a factor of 16 percent in the first stage - for instance, from 3 percent to (3 x 1.16 =) 3.48 percent - an additional 25 percent in the second stage, and yet another 27 percent in the third stage. This turned a 3 percent initial annual growth rate to 5.52 percent in the third stage. In the next sections we quantify the impact of quotas under the ATC, and the evolution of their economic effects over the full ATC implementation period.

3 Estimating Framework

3.1 Export Tax Equivalents

In this section, we provide a basic outline of our techniques for non-linear panel estimation of NTBs. More detail is provided in the technical annex. We first correct for bias in price elasticity estimates (a critical component in calculating the price impact of quotas) by employing a 2-step estimation procedure. We do this because we expect (an expectation supported quite strongly by the data and discussed below with respect to Tables 2 and 3) that trade elasticity estimates are biased downward when the sample includes quota-constrained trade. Second, we base our estimates on joint estimation across a broad sample of importers and exporters. This differs from the econometric literature in this area, which tends to focus on single importers. (See for example Evans and Harrigan 2005.) Our approach allows us to integrate the estimation process for price impacts with the panel-based estimation of the underlying gravity model. Third, we also impose non-linear constraints on the quotas, acknowledging the fact that a quota can only be binding or zero, but never act as a subsidy for exports. This introduces the mixed-complementarity aspect of the estimation problem. Finally, as we are working with estimates based on a large non-linear econometric system, we introduce Gaussian quadrature to estimate confidence intervals of our coefficient estimates. This means we implement a technique for assessing robustness of our residual-based quota estimates given parameter uncertainty.

The impact of quantitative restrictions on trade is reflected in per-unit economic rent generated by a binding quota. This is because a binding quota effectively limits the supply of the good in the importing market, resulting in a price markup and giving economic rents to those suppliers who have access to the market (i.e. who are able to export inside the quota). Since the quotas on textiles and clothing were administered as "voluntary" export restraints by the suppliers, often with the quotas distributed by auction, these rents can alternatively be seen as an implicit tax on exports. For these reasons, the effect of the quotas in the literature is generally expressed as an *export tax equivalent* or ETE.

3.2 Data

We work with trade and tariff data from the UN COMTRADE database and the WTO's database of applied tariffs, supplemented where necessary with information from the UNCTAD TRAINS database. These data are available through the UNCTAD/ World Bank WITS (World Integrated Trade Solution) data system, and yield trade and applied tariff data spanning from 1996 to the most recently released data. For EU Members, we have had to combine common external tariff data from the WTO with individual Member import data from COMTRADE. Our trade and tariff data have been combined, in turn, with data on geographic distance taken from CEPII's recent compilation of various distance measures. (See Clair et al 2004.) We are estimating the quota impact separately for the textiles sector and the clothing sector. In total, this yields a database with 47,500 observations on bilateral textile trade flows and 44,452 observations on bilateral clothing trade flows, including 27,442 observations on OECD textile imports and 26,071 observations on OECD clothing imports. These data cover bilateral trade during the ATC – i.e. from 1996 to 2004.

Not all countries have reported recent data to UNCTAD on a timely basis (a problem especially for developing countries) so that there are missing data on country pairs for later years. Annually, the data range between roughly 2,200 and 7,000 bilateral flows per year and sector.

For the period covered by our sample, import quotas were maintained by the United States, Canada, and the (then 15) Members of the European Union. The US import quotas (not all involving WTO Members) covered 46 exporters. The European Union import quotas (again not all involving WTO Members) covered 20 exporters. [5] Canadian quotas covered 43 exporters at the launch of the ATC. In our sample, 18,412 of our textile data points involve imports by quota users, while 17,787 of our clothing data points involve imports by quota users. For the United States, we have 10 years of trade flows with 46 quota countries, or 460 bilateral time-country pairs impacted by quotas. For Canada we have 9 years of trade flows for 43 quota countries, or 387 bilateral time-country pairs impacted by quotas. For the European Union, because they ran a common quota system, we have 9 years of trade flows for 15 EU importers and 20 quota exporters, or 2,700 time-country pairs impacted by quotas and 180 observations on trade flows per quota.

[5] We note that the EU's quota monitoring system, SIGL, lists more countries. However, while more exporters are listed in the SIGL database, closer inspection of these entries reveals that the EU was only using quotas actively against the 20 partners identified in our sample during the ATC.

3.3 The Estimating Equations

Following almost all of the recent literature (Anderson and van Wincoop 2004,Feenstra 2002) we start by specifying CES import demand functions.[6] As we are working with data that reflect actual trade flows and actual prices, and for which therefore price indexes can be taken as given and controlled for with dummy variables in each cross-section, this is consistent with either the Armington approach to modeling trade flows or Ethier/Krugman-type monopolistic competition based on CES demand for varieties produced by firms. When we turn to our data, we treat each year in our panel as representative of an equilibrium set of prices and transaction quantities.

Formally, starting from CES preferences, if we take any importing country j, then the first order conditions from constrained optimization of the CES composite given expenditures imply that demand for imports from source country i can be written as follows:

$$m_{ij} = E_j \left(\frac{p_{ij}}{\alpha_{ij}} \right)^{-\sigma} P_j^{\sigma-1} \tag{1}$$

where m_{ij} represents total imports by country j from country i, E_j is total expenditure on the product category, p_{ij} is the internal price index for goods imported from country i, α_{ij} is the country weight from the standard CES aggregator: $M = \sum (\alpha_{ij} m_{ij}{}^{\rho})^{1/\rho}$, P_j is the CES composite price index linked to this aggregator,

[6]We can obtain a more general version of equation (1) in percent differences by manipulation of a standard import demand function where imports are (imperfect) substitutes for each other. The CES representation is then a special case which we use as it maps directly to the standard representation of import demand in national and firm-level product differentiation models, in the modern gravity model literature, and in numerical trade models.

and σ is the absolute value of the Allen-elasticity of substitution. We will later impose identical weights α across OECD importers, so that we can drop the second subscript.

We can in turn map world prices for goods, indexed across exporters i, to internal prices, indexed by importer j, as follows:

$$p_{ij} = P_i^* \left(1 + \tau_{ij}\right) \left(1 + \omega_{ij}\right) \gamma_{ij} \tag{2}$$

In equation (2), P_i^* is the world or fob price index for exports from country i, τ_{ij} is the bilateral tariff applied to imports from country i sold in country j, ω_{ij} is the export tax equivalent of quantitative restraints, measuring the price impact of non-tariff barriers, and γ_{ij} measures transport costs following from goods moving between i and j. Such costs may be a function of geographic distance, for example, as is well established in the gravity equation literature. (See for example Disidier and Head 2003 and Anderson and van Wincoop 2003.)

To move from equations (1) and (2) to estimating equations, we first substitute equation (2) into equation (1), neglecting the quantitave constraints for a moment, and then take logs. We also add our time subscripts at this stage. This yields equation (3).

$$\begin{aligned} \log m_{i,j,t} \quad = \quad & \log E_j - \sigma \log P_i^* - \sigma \log \left(1 + \tau_{ij}\right) \\ & -\sigma \log \gamma_{ij} + \sigma \log \alpha_{ij} + (\sigma - 1) \log P_j \end{aligned} \tag{3}$$

We use exporter dummies to control for *fob* price indexes, such that with the dummies in place the values of imports net of trade and distance barriers then map to quantities. These dummies also control for an important effect in the recent literature – systematic variations in unit values linked to individual exporters and importers. (See Schott 2004). We also assume importers assign similar CES country weights α in the cross-section, and specify transport costs γ_{ij} as a function of both geographic distance D_{ij} and a dummy for common borders B_{ij}. Finally, we control for both the domestic internal price index P and the set of import CES weights through time-varying importer and exporter dummies X and M. Through this specification we eliminate what Baldwin and Taglioni (2006) label the gold-medal error (omission of the multilateral trade resistance term according to Anderson and Van Wincoop 2003) as well as the bronze-medal error (i.e. problems arising from the incorrect specification of trade and GDP figures).[7] For our panel of observations indexed over time t we therefore have:

$$\begin{aligned} \log m_{ijt} &= -\sigma \log(1+\tau_{ijt}) + \beta_{border} B_{ij} + \beta_{distance} \log D_{ij} \\ &\quad + \beta_{time} t + X_{it} + M_{jt} + e_{ijt} \end{aligned} \tag{4}$$

When we introduce quotas, we take advantage of the fact that in observed trade data, expenditures will reflect the price impact of the quotas. This allows us to estimate the manifestation of these price effects through the export-tax equivalent of the quota. Here, we follow much of the recent literature, where the coefficients on NTBs are assumed to capture the tax or price equivalent of the NTBs in question. (See for

[7]The use of country fixed effects in the recent literature on trade elasticities also offers an elegant solution to a problem plaguing the earlier literature, linked to the estimation of unit values from trade value and quantity data. See Shiells (1991) and Reinert and Shiells (1993) for discussion.

example the thorough discussion in Anderson and van Wincoop 2004).[8] However, it is then important to recognize that a quota is either binding, or not binding. This means that the export tax equivalents of the quota ω_{ij} will be either positive or zero, but will not be negative. We therefore impose inequality constraints on the ETEs of the quotas. Finally, as we are working with a panel, and we know that the ATC involved a staged process of quota expansion, we assume we can model the evolution of the ETEs over time using a truncated fourth-degree polynomial (meaning that its applicability in time t depends on whether or not the inequality constraint is binding.) Putting all this together, we have:

$$\begin{aligned} \log m_{ijt} = \quad & -\sigma \log(1+\tau_{ijt}) + \beta_{border} B_{ij} + \beta_{distance} \log D_{ij} \\ & +\beta_{time} t + X_{it} + M_{jt} \\ & -\sigma \log(1+\omega_{ijt}) + e_{ijt} \end{aligned} \tag{5}$$

$$\log(1+\omega_{ijt}) = \quad \max \begin{cases} a_{ij} + a1_{ij}t + a2_{ij}t^2 + a3_{i,j}t^3 + a4_{ij}t^4 \\ 0 \end{cases} \tag{6}$$

[8]There are several issues here related to choice of functional form and conservation of degrees of freedom. For example, Anderson and van Wincoop (2004) note that almost the entire literature relies on log linear cost specifications for our equation (1), which corresponds to equation (11) in their paper. However, an alternative involves strictly linear versions, though there is then a trade-off between degrees of freedom and generality. Since additive costs can be transformed into log-additive costs (for example by normalizing prices), we do not see this as a critical issue. More important is conservation of degrees of freedom. In much of the literature, estimates of NTBs are based on single year residuals, yielding point estimates. Alternatively, to deal with degrees of freedom issues, Trefler (1993) basically assumes that U.S. NTBs have the same trade-reducing effect for all goods in a product category that it imports from the rest of the world, while Harrigan (1993) assumes that the importing country's NTB has the same trade displacement effect for each exporter from which it buys a good. The middle-road followed here is to specify a polynomial for the evolution of NTB price effects, again conserving degrees of freedom.

The inequality constraint on the matrix of export tax equivalents is reflected in equation (6).[9] Combined with the equality of the tariff and quota price elasticity σ in equation (5), this puts us in the realm of non-linear inequality constrained mathematical programming problems when we focus on the estimation of the quota price wedges ω. [10]

4 Estimated ETEs: The Evolution of Quota Rents

Tables 2 and 3 report ordinary least square (OLS) estimates for equation (4). The first column in both tables shows OLS results for the full sample, while the subsequent columns show OLS results for the sub-samples of non-OECD countries, OECD countries, and OECD countries excluding quota users. Thus, columns 1 and 3 are based on a mixed sample of quota constrained and quota free exporters, while columns 2

[9] While not reported here, we have also estimated three different sets of quota price effects mapped to ATC stages 1, 2 and 3 as indicated in Table 1. The fit of the regression is better when allowing for a more flexible, non-linear time trend over the whole period, though the results of both sets of estimation are basically the same. Since many factors influencing the cost effects of the quotas (like for instance supplier capacity, tariffs, regional agreements, etc.) change annually and not with the different stages of the ATC, it seems reasonable to allow for greater flexibility in the estimation. Higher degree polynomials do not yield any real difference in the fit of the model to the trade data, based on a comparison of the resulting ETEs.

[10] At first sight our estimation problem might appear to suffer from too few degrees of freedom. However, we are estimating equations 5 and 6 based on the full set of quota constrained and quota free pairs of trading partners. Thus, we have to estimate "only" 109 sets of bilateral quota coefficients. In combination with our coefficients on distance and border variables and the like, time variables, time varying importer fixed effects, and time varying exporter fixed effects and quota coefficients, we have a total of 1607 fixed parameters to be estimated from a sample of roughly 47500 observations. Our use of a constrained polynomial with the panel allows us to conserve degrees of freedom, offering a marked improvement over the direct residual approach. In our panel it leaves us with 5 degrees of freedom for the U.S. and Canada per quota exporter and 160 per quota exporter for the European Union (as we have 15 countries with the same quota) instead of essentially zero degrees of freedom with strict residual methods. It also offers an alternative to making more restrictive assumptions across country pairs to conserve degrees of freedom, as discussed in Anderson and van Wincoop (2004).

and 4 are based on non-quota suppliers only. As quantity constraints, by definition, limit price-sensitivity, we expect this to bias downward any estimate of price sensitivity. As a consequence, we expect a lower estimate of the tariff elasticity in colums 1 and 3 as compared to the unbiased estimates in columns 2 and 4. Indeed, the pattern is one of significantly different, and higher, tariff elasticities when we exclude the countries that utilize quotas. The difference between columns 2 and 4 is not significantly different at the 5%-level in either table. In other words, given our estimates from Tables 2 and 3 we cannot reject the hypothesis that OECD countries have the same elasticities as non-OECD countries, once we control for quotas. Assuming that the same elasticities that apparently map to both non-OECD and OECD non-quota importers also map to OECD quota-importers, we are able to convert our quota coefficients into ETEs using these elasticities.

Because estimated price elasticities are otherwise biased downward, to avoid this bias when estimating quota price effects through the system of equations (5) and (6) we start by imposing the estimated elasticities for the quota-free sub-sample in column 4. The estimation problem is then specified as a minimization problem with mixed-complementarity constraints, where we impose the system of equations (6) and solve for the set of non-negative quota coefficients and importer and exporter dummies that minimize the sum of squared errors.[11] The resulting estimated nonlinear time trend of quota price effects gives us a broad sense of the evolution of the quota wedges over the stages of the ATC phase-out period. Gaussian quadrature is

[11] Our OLS results in Tables 2 and 3 were estimated in STATA, while the constrained least squares estimates of the quota premiums, including the application of Gaussian quadrature, were estimated with GAMS.

employed, based on the first and second moments of coefficients reported in column 4 of Tables 2 and 3 (with the CBI coefficient estimates taken from column 3) to obtain the standard errors used to calculate t-ratios reported in the detailed annex tables. More details on this approach are provided in the technical annex. The full set of estimates by importer and exporter is reported in Annex Tables A-1 to A-6. Summary results are reported in Table 4. In the tables, blanks means there were no quotas (like US exports to the EU15 in Table 4) or the quota was estimated to be non-binding (like Singapore exports to Canada in the later years in Table A-1). The general pattern is one of significant ETE estimates at the start of the ATC, falling over time as the quotas are phased out. The important exception is China. Figure 1 shows the evolution of two of the politically most significant sets of ETEs (China and India) over time.

Table 4 reports information on the top five suppliers in textiles and clothing for the quota using importers, Canada, the USA, and the EU. Since China ranged among the top suppliers for all quota users in 2001, the evolution of the Chinese export tax equivalents as implied by the quotas can be read from the table. Canada is the quota user most compliant with the ATC among all three. The reduction in price wedges for China is especially impressive. Between 1996 and 2003 the export tax equivalent was reduced to zero from an estimated 30.4 percent of export price for clothing. Also against other suppliers, liberalization was substantial in Canada, even if some high barriers remained, mostly against minor suppliers (for instance Jamaica, Qatar, and Morocco). Further, as reported in Francois and Spinanger (2004), Canada - like the US - maintained a pattern of strong protection against suppliers of wool products. This results in high constraints for Eastern European suppliers on the North American market.

Turning to the US, export tax equivalents for China actually went up. Figure 1 shows that this was not a linear trend. Some reduction in ETEs took place until the end of the second stage of the ATC. Especially notable is the spike at the end of the ATC. It seems reasonable to blame this spike for contributing to the political problems caused by a surge in imports from China in early 2005. These ended with the reimposition of quotas in later 2005. The spike in US quotas follows from the interaction of several factors. The first factor is the failure of quota growth to keep up with growth in potential trade. This is illustrated in Table 5. The table quantifies the strong expansion of the Chinese economy and thus the huge increase in export potential over the life of the ATC. This growth well surpassed quota growth rates. While the Chinese quotas on the US market increased by 33 percent in textiles and 41 percent in clothing between 1994 and 2004 (see Table 5), Chinese GDP rose by 170 percent over the same period. With a cumulative growth of 61 percent, already the US GDP growth - as a proxy for the growth of import demand - surpassed the rate of quota expansion. Another factor was the ability to "borrow forward" on quotas. This meant that, for example, in late 2000 importers could borrow against 2001 quota limits. Obviously, by late 2004, there were no more quotas to borrow against, contributing to the late spike in US ETEs as the system, by construction, became increasingly restrictive.

Note that, like Canada, the US also had substantial protection against East European suppliers. This corresponded to a narrow set of wool-based products that were restricted by US quotas. These quotas were not really an issue at the end of the Uruguay Round. In 1993, these countries were emerging from the fog of communism, and were not major players on world markets. Detailed examination of the quota and trade categories involved shows that the North American regimes were protecting domestic producers of wool fabrics, suits, and related items. This protection was quite high. Finally, several countries did graduate into liberal trade regimes. This includes many of the lower-income Asian and African suppliers, as reflected by their absence from the Tables.[12]

Overall, despite the surge in ETEs for the US shown in Figure 1, the observed backloading of trade liberalization vis-à-vis China should not be surprising and cannot be ascribed purely to non-compliance with the ATC. It was instead a consequence, in part, of the design of the system. At the same time though, our results do suggest that the US in general did not implement the ATC according to plan. Between 1996 and 2004, protection against restricted suppliers went up for 15 WTO exporters of textiles - with increases in tariff equivalents greater than ten percent for Indonesia, China, Poland, the Czech Republic, Hungary, Uruguay, and Slovakia. Only four WTO suppliers - Cambodia, Macedonia, Brazil, and Pakistan - faced decreasing export tax equivalents during the ATC. For clothing, three suppliers - Uruguay, Cambodia, and India - saw a fall in their ETEs, while nine suppliers faced increasing price distortions - Turkey, Bulgaria, China, Poland, Hungary, Slovakia,

[12] Also note that in 2001-2002, Vietnam graduated from Smoot-Hawley to MFN tariffs. Vietnam's trade is mapped to MFN tariffs in the WITS database, though in actuality it faced Smoot-Hawley tariffs. While we do not report the results for Vietnam here (they are not members of the WTO and were not part of the ATC) we have included Vietnam with Smoot-Hawley dummies in our estimating framework. Indeed, the move to MFN rates is reflected in a dramatic drop in our estimate of Vietnam's dummy coefficients when moving into ATC Stage 3.

Romania, and the Czech Republic. The latter three faced increases to more than 50% of delivered prices. Finally, several countries with quotas had already moved toward a liberal trade regime, including many of the lower-income Asian and African suppliers. This can be concluded from the absence of binding quotas under the ATC.

While there is a clear pattern toward liberalization for imports to the European Union, the degree of liberalization was more limited than in the Canadian case. Although trade with China became more liberalized, the degree of protection remained high at the end of the ATC.[13] Figure 1 and Table 4 both show the fall in protection against China. However, the tariff equivalents at the end of the ATC remained substantial. The removal of the quota system by 2005 thus implied a substantial surge in imports from China. Indeed, preliminary 2004 and 2005 figures showed tremendous increases in China's market share in the EU market, leading to a re-imposition of quotas by the middle of 2005. We estimate that textile and clothing imports from India were no longer restricted by the quotas in 2003. As such, the removal was not expected to show strong direct effects. Similar to the US market, imports from Vietnam were also restricted on the EU market at the end of the ATC. The estimated tariff equivalents were comparable to those for China. Thus, while the EU has moved toward more liberalization in textiles and clothing, protection remained high against China and Vietnam when the final stage of full liberalization in the ATC was reached. As a consequence, substantial restructuring among suppliers on

[13]Due to the reporting procedures for the EU to UNCTAD, we do not have full EU import data for 2004. (Neither do we have full Canadian data.) Given that the ATC was implemented in stages with 2003 and 2004 both in the third stage, and that the EU and Canadian systems did not have borrow-forward provisions, we use 2003 estimates as upper bounds for 2004 in the discussion and in Figure 1.

the European textile and apparel market starting in 2005 should not be surprising.

The results reported in Table 4 and the annex tables are broadly in line with other, auction-based estimates in the literature as reported in Table 6. There are of course some differences between various estimates of protection due to differences in methods, quota price information, and aggregation problems. For example, the estimates by Mlachila and Yang (2004) and by Andriamananjara et al (2004) are both based on different sets of auction prices, while our estimates are based on a gravity model. In general, our estimates and both of theirs all report higher protection rates in the clothing industry than in textiles. This is reasonable, since textiles are one of the major inputs in clothing, thus blocking textile imports would hurt the domestic clothing industry, whose protection stands behind the quota system, in the importing countries. The results for protection against China are broadly in line between the three different studies. Protection against imports from China remained high until the very end of the quota system in 2005. [14]

5 Summary and Discussion

In this paper we have developed a panel-based framework for estimating the export tax equivalent (ETE) of quotas where the ETEs vary over time. We use this framework to examine the evolution of market access conditions in the textile and clothing sectors. We work with a panel of bilateral data on textile and clothing trade, underlying bilateral tariffs, and the country-pair coverage of quotas under the WTO's

[14] For smaller suppliers our estimates tend to be higher than auction-based estimates. As auction prices reflect the rents accruing to exporters, this makes sense to us. Our estimates should also capture the portion of rents accruing to importers.

Agreement on Textiles and Clothing (ATC). Our estimating framework takes advantage of the panel nature of trade data when calculating export tax equivalents while allowing for inequality constraints on the quota premium estimates. We also implement quadrature methods for calculating confidence intervals for our regression-based NTB measures.

The estimation results we present highlight the advantage of using a non-linear panel estimation procedure for this type of problem. In particular, we are able to estimate the time-path of quotas, while also allowing particular quotas to shift between being binding and non-binding. Such discrete changes in the price impact of quotas makes sense, as macroeconomic shifts like exchange rate movements can have dramatic effect on the relative competitive position of particular suppliers in particular export markets. Indeed, we do identify such changes over the 10-year span on the ATC, even in cases where the overall trend is toward liberalization. An additional advantage of the two stage process is that we are able to control for bias in elasticity estimates that follows from the quotas themselves. This is quite important, as the elasticities are themselves necessary for ETE estimation. Finally, an advantage of the overall approach is our robustness checks through Gaussian quadrature.

While emphasis has been placed, in part, on our approach to estimating the price impact of quotas, the actual estimates also merit discussion. In our view the estimated price effects presented here offer some explanation for the political difficulties that followed the ATC's end days. The ATC embodied commitments to a ten-year, staged reduction in quotas. The process was meant to be orderly, systematic, and transparent. Yet the end of the ATC brought with it sudden surges in imports from China, panicked trade ministers, rushed meetings, and the reimposition of quotas on China by late 2005. This episode is fully consistent with our results. A key implication from the temporal pattern of our econometric results is that the problem of China's textile and clothing sector integration was basically deferred rather than managed in stages. This was not solely a result of the ATC itself, but was certainly reinforced by insufficient pre-defined quota expansion rates during a period of outstandingly strong expansion of China's supply potential.

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Technical Annex

In this annex we provide more technical detail on the estimation procedure used. This includes our two-step procedure to correct for bias in the trade price elasticity estimates, the ICLS estimator, and the use of Gaussian quadrature to obtain standard errors as a robustness check for the ETE estimates for quotas.

Two-Step Estimation and ICLS

Because we are controlling for country-specific effects with dummies, variations in our log of tariff markup variable τ on a bilateral country-pair basis map directly to log variations in bilateral pair prices p_{ij} and therefore provide us with a direct estimate of import price elasticities *assuming* imports vary with respect to price. However, as discussed in Section 4, trade elasticity estimates from a single equation model where equation (4) is applied to a full sample (inclusive of quota-using importers) may be biased downward by the effect of quotas on trade for ATC importers. This means we will not have imports varying with respect to bilateral price variation with quotas. In formal terms, if there is a quota, then the log form of equation (1) will be as follows:

$$\log m_{ij} = \min \left| \begin{array}{l} \log E_j + \sigma \log \alpha_{ij} - \sigma \log p_{ij} + \sigma \log P_j \\ \\ \log \bar{q}_i \end{array} \right. \tag{7}$$

In the second case, if the quota $\bar{q}_i$ is binding, there will be a share of the sample for which there is no variation on the left-hand side linked to variations on the right hand side. In other words, a simple application of the gravity model at the sector level in the presence of quotas but without controlling for quotas, will bias our estimates. This is because a regression with the quota sub-sample implies zero substitution in response to price (i.e. tariff) effects. Combining these observations in the unconstrained sample then yields downward-biased substitution elasticities. To control for this bias we first estimate trade elasticities for a restricted sample that excludes quota-using importers, using equation (4), and then impose the resulting estimates of coefficient means and standard deviations on the unrestricted (inclusive of quotas) sample using equations (6) and (5) to estimate the underlying ETEs for the full sample. This means that the first and second moments of our quota wedge estimates from the second stage estimation, being based on full-sample residuals, are a function of the corresponding moments for the trade elasticities that were estimated in the first stage. We control for systematic variations in unit value, as stressed in the quality literature, through country dummies.[15]

In the second stage we estimate our constrained non-linear optimization problem with inequality constrained least squares (ICLS). This involves least-squares estimation of equations (5) and (6), given our unbiased coefficients estimated in the first stage for a split sample of quota-free importers. As detailed below, we use quadrature to gauge the distribution of coefficients in equation (6), given uncertainty linked to first stage coefficients. The numerical method we use here is robust to highly

[15] The recent empirical literature has stressed both differences in unit values and differences in substitution elasticities. For example, Schott (2004) offers strong evidence of consistent quality variation depending on the level of development of the exporter. We control for such systematic unit value variation by importer or exporter through our country dummies. A second issue in the literature relates to systematic variation in substitution elasticities. This includes Hallak and Schott (2005). While we test for such variation using split samples (see the discussion of Tables 2 and 3 below) we are unable to reject the hypothesis that once we control for quotas, the elasticities for rich and poor countries are the same.

non-linear least-squares objective functions with inequality constraints. In brief, the algorithm involves GRG-based triangulation, calculation of first and second derivatives, and a "search" routine that follows out possible paths on the local gradients for unmet constraints that seem to indicate convergence. [16] Chong (1976) finds that ICLS estimators have consistently lower mean squared errors for large samples, and for sufficiently large samples are unbiased and consistent. Geweke (1982) uses Monte Carlo simulations to demonstrate the problems of ignoring inequality constraints for Bayesian inference.

Gaussian Quadrature

We are interested not only in the ETEs themselves from equation (6), but also in the robustness of the estimates with respect to underlying uncertainty in our estimates of key parameters in equation (5) in the first stage. One obvious solution is Monte Carlo simulations at the second stage. However, we are working with a large non-linear system of over one hundred equations with inequality constraints estimated over almost 50 thousand observations. Also, as noted by Haber (1970),

[16] Technically, ICLS, by definition, is a special case of the broader class of constrained optimization problems. GAMS (2005) offers a number of solvers, employing quite different solution algorithms, for optimization problems involving large non-linear systems of equations subject to equality and inequality constraints. While we have experimented with several of the solvers (i.e. algorithms) implemented in GAMS, we have used CONOPT here (Drud 2005). In the present context, CONOPT seems to offer better performance than other GAMS options, like the MINOS and SNOPT solvers. It is quite likely though that in other cases one of the these other algorithms may perform better. (See GAMS 2005 for more on these). GAMS/CONOPT uses an algorithm based on the Abadie and Carpentier (1969) generalized reduce gradient (GRG) algorithm first suggested by Abadie and Carpentier (1969). Actual implementation, reflecting modifications that make it more efficient for large models is described by Drud (1985, 1992). Detailed information is provided in the technical annex of Drud (2005). While GAMS/CONOPT was originally designed for models with smooth functions, it can also be applied to models that do not have differentiable functions (discontinuous nonlinear programming models).

Monte Carlo simulations do not necessarily assure reasonable accuracy. In addition, to allow for future applications of this type of method involving larger panels, we really want a less computationally intensive approach. To this aim, and as an alternative to Monte Carlo simulations, we use order three Gaussian quadrature[17] to estimate the variance of our ETE estimates given that they are based on our estimates of the elasticities in equation (5). Gaussian quadrature has been applied to discrete approximation of the conditional properties of time series for asset pricing models by (Taussen and Hussey 1991), and also in statistics more generally for non-parametric estimation of the properties of distribution space (Anderson and Aitkin, 1985; Laird 1978, Aitkin 1999). Laird (1978) and Ma et al. (1996) both demonstrate the usefulness of this method for approximating distribution functions (as in the distribution of our quota estimates) without assuming specific parametric forms for the distributions. Aitkin (1999) stresses the computational advantages of using quadrature for non-parametric maximum likelihood estimation.[18]

Formally, we characterize the solution for a third order approximation for the distribution of a set of random variables v specified as a function of stochastic vari-

[17] Gaussian quadrature builds on treating numerical problems with stochastic exogenous variables (in this case our second-stage least squares estimation building on uncertain coefficient estimates from the first-stage least squares estimation) as numerical integration problems. Research on numerical methods suggests that quadrature methods are preferable in several ways to Monte Carlo methods, in many cases being both less computationally demanding and at the same time more accurate (Geweke 1986, Judge and Takayama 1966, Schürer 2003, Tauchen and Hussey 1991). It involves discrete state-space approximation methods (instead of Monte Carlo methods) for estimating the properties of a given parameter space. See Ma et al (1996) for a discussion of Gaussian quadrature as applied to functions ranging from smooth to those characterized by endpoint singularities.

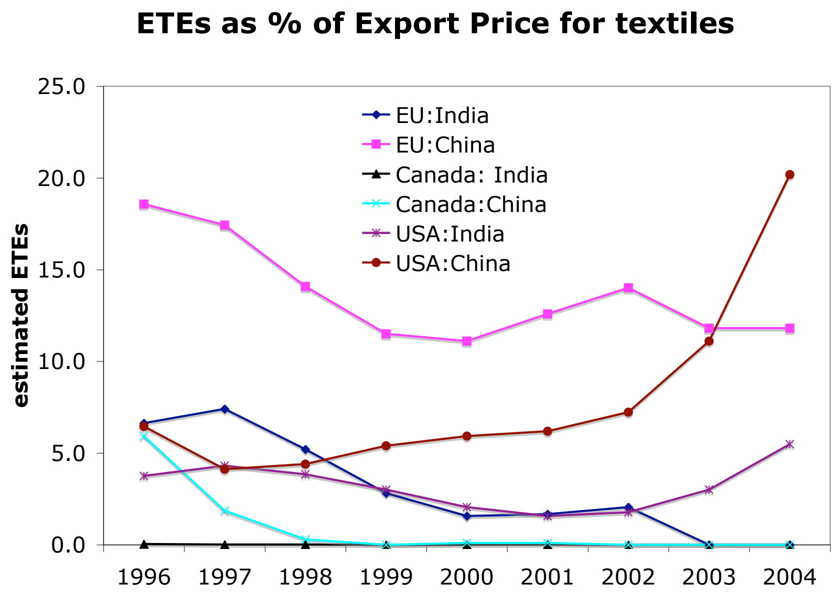
[18] This approach has also become relatively standard for assessing uncertainty in numerical solutions with respect to parameter uncertainty in large-scale general equilibrium models. (See Arndt 1996, Plumb 2001, and Hertel et al 2004).

ables x. (Stroud 1957, 1960, 1967). This follows Stroud's solution of defining a set of systematic draws in x space sufficient to obtain estimates of the mean and variance of our variables v. Formally, for n stochastic variables, we need only $k = 2n$ draws. Each draw starts by taking $g = n/2$ pairs (taken to the greatest integer not exceeding $n/2$) of systematic draws of stochastic variables γ with mean zero and standard deviation one, denoted by $\gamma_{g,k}$. This yields a matrix Γ of coefficient pairs γ_g, with the number of rows equal to the number of stochastic variables x (equation 8) and each column defining one quadrature in our parameter space (equation 9). In particular, denoting the vectors of the mean and standard deviation of variables x by μ and σ and assuming that σ is diagonal, the desired quadrature (the set of systematic draws on x) is obtained as defined in equation (9).

$$\gamma_g = \left| \begin{array}{l} \sqrt{2}\cos\left(\frac{(2g-1)k\pi}{n}\right) \\ \\ \sqrt{2}\sin\left(\frac{(2g-1)k\pi}{n}\right) \end{array} \right. \qquad (k = 1, 2, ..., 2n) \qquad (g = 1, 2, ...[n/2]) \tag{8}$$

$$\Phi = \mu + \Gamma\sigma \tag{9}$$

Once we have the matrix of systematic draws on x, represented in equation (9) by Φ, we then need to take this set Φ and solve the second-stage least squares estimation problem $2n$ times, one with each set of draws on x in Φ. The resulting set of estimates for v can then be used to directly estimate the mean and variance for v.



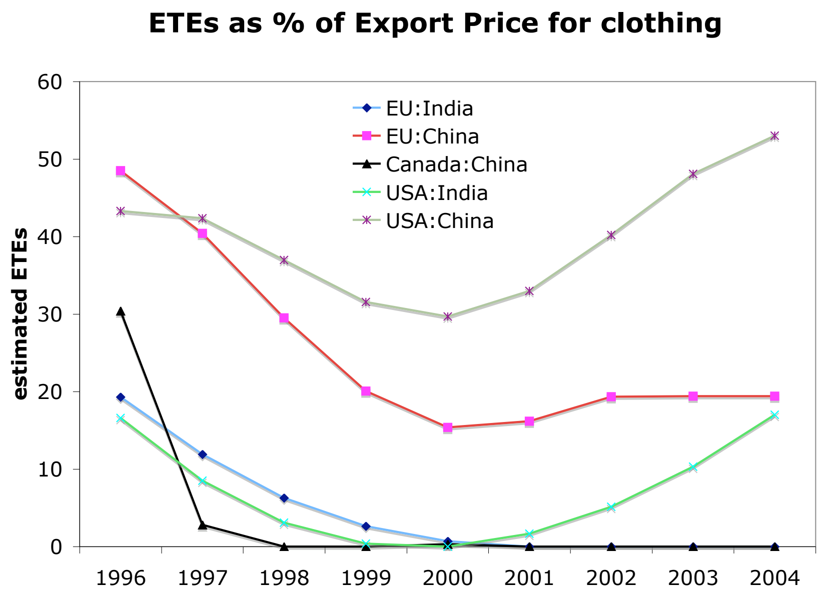


Figure 1: The Evolution of Textile and Clothing ETEs for China and India

Table 1
A Parade of Acronyms: the evolution of quotas

year	*overview of events*
1955-57	US-Japan dispute leads to a 5 year agreement limiting textile exports
1958	United Kingdom imposes "voluntary" limitation on cotton T&C products with Hong Kong, by threatening to otherwise impose quotas at levels lower than prevailing volumes.
1959	United Kingdom signs restraint agreements with India and Pakistan.
1960	GATT Contracting Parties recognize the problem of "market disruption" to serve as an "excuse" for establishing future NTBs.
1961	**STA**: The Short Term Arrangement (STA) is agreed.
1962	**LTA1**: The Long Term Arrangement (LTA) is agreed, to commence October 1, 1962, and last for five years.
1963-65	US tries and fails to establish agreement on trade in wool products
1966	The United Kingdom implements a global quota scheme in violation of the LTA. The LTA provides only for product-specific restraints.
1967	**LTA2**:Agreement is reached to extend the LTA for three years.
1969-71	United States negotiates VERs with Asian suppliers on wool and man-made fibers.
1970	**LTA3**:Agreement is reached to extend the LTA for three years. It was later extended three months more, to fill the gap until the MFA came into effect.
1973	**MFA I**:The MFA is agreed, to commence January 1, 1974, and to last for four years.
1977	The European Economic Community and the United States negotiates bilateral agreements with developing countries prior to agreeing to extension of the MFA.
1977	**MFA II**:The MFA is extended for four years.
1981	**MFA III**:The MFA is renewed for five years. The USA, under pressure from increased imports resulting from dollar appreciation, negotiates tough quotas.
1986	**MFA IV**:The MFA is extended for 5 years, to conclude with the expected end of the Uruguay Round.
1991	**MFA IV+**:The MFA is extended pending outcome of the Uruguay Round negotiations.
1993	The Uruguay Round (UR) draft final act provides for a 10-year phase-out of all MFA and other quotas on textiles in ATC. MFA extends until UR comes into force. ATC allows credit for liberalization in products that are not actually restricted.
1995	**ATC1**:1st ATC tranche liberalized 16% of 1990 imports.
1998	**ATC2**:2nd ATC tranche liberalized 17% of 1990 imports.
2001	**ATC3**:3rd ATC tranche liberalized 18% of 1990 imports.
2005	**ATC4**:4th ATC tranche liberalized 49% of 1990 imports. ***Déjà vu*** all over again: US and EU re-impose quotas on China.

Source: Based on an update of Francois, Glismann, and Spinanger (2000).

Table 2
Textile Regressions

coefficient	All countries	Non-OECD importers	All OECD importers	Non-quota OECD
$ln(1+t)$	-5.43***	-7.60***	-3.11***	-6.57***
	(-23.57)	(-24.64)	(-8.54)	(-13.24)
$distance$	-1.36***	-1.50***	-1.06***	-1.13***
	(-82.95)	(-65.82)	(-40.23)	(-28.81)
$border$	0.79***	1.39***	0.37***	0.29**
	(11.92)	(13.81)	(4.50)	(1.97)
EEA	0.26***	0.81***	0.02	0.51***
	(4.86)	(13.81)	(0.27)	(4.53)
$NAFTA$	0.08	.	1.55***	1.47***
	(0.26)		(5.50)	(2.94)
CBI	0.96***	.	1.85***	.
	(6.82)		(13.96)	
adj. R-sq:	0.735	0.694	0.812	0.811
obs:	46,672	19,235	27,437	9,030
df:	44,179	17,161	25,235	7,237
F:	52.92	22.07	49.34	22.60
Pr>F	0.00	0.00	0.00	0.00

EEA ... European Economic Area; NAFTA ... North American Free Trade Agreement; CBI ... Caribbean Basin Initiatve; *** (**) denotes>.01 (.05) level of significance; t-ratios in parentheses.

Table 3
Clothing Regressions

coefficient	All countries	Non-OECD importers	All OECD importers	Non-quota OECD
$ln(1+t)$	-0.08	-2.26***	0.02	-2.09***
	(-0.28)	(-4.65)	(0.04)	(-3.98)
distance	-1.39***	-1.42***	-1.08***	-1.24***
	(-81.59)	(-58.07)	(-40.44)	(-32.38)
border	0.83***	1.35***	0.51***	0.56***
	(12.25)	(12.72)	(5.98)	(3.62)
EEA	0.36***	0.72***	0.42***	0.10
	(6.37)	(7.35)	(5.55)	(-0.92)
$NAFTA$	0.31	.	1.34***	1.35***
	(1-02)		(4.71)	(2.78)
CBI	0.14***	.	2.09***	.
	(9.23)		(15.57)	
adj. R-sq:	0.745	0.672	0.800	0.797
obs:	43,273	17,202	26,071	8,284
df:	40,811	15,251	23,884	6,578
F:	52.25	15.83	48.47	20.10
Pr>F	0.00	0.00	0.00	0.00

EEA ... European Economic Area; NAFTA ... North American Free Trade Agreement; CBI ... Caribbean Basin Initiatve; *** denotes>.01 level of significance; t-ratios in parentheses.

Table 4
Top 5 Import Suppliers

	2001 import share	2001 tariff	ETEs as % of export price	
			1996	2003
	EU15 : textiles			
Turkey	14.0	0.0		
China	9.1	8.2	18.6***	14.0***
India	8.1	7.5	6.6***	2.0***
United States	4.7	6.4		
Pakistan	4.6	0.0	13.1***	3.2***
ALL	100.0	1.8	1.8	0.7
	EU15 : clothing			
China	17.1	10.6	48.5**	19.4***
Turkey	8.5	0.0		
Romania	6.6	0.0		
Tunisia	6.2	0.0		
India	5.8	8.5	19.3***	
ALL	100.0	3.2	13.1	3.6
	USA : textiles			
Mexico	12.7	0.1		
European Union	10.9	8.5		
China	10.2	7.4	6.5***	7.2***
Canada	7.7	0.0		
Pakistan	5.4	9.0	5.2***	
ALL	100.0	7.9	3.8	3.5
	USA : clothing			
China	13.3	9.8	43.3***	48.1***
Mexico	12.1	0.1		
Hong Kong	6.9	11.5		
European Union	4.5	10.1		
Indonesia	4.3	12.7		
ALL	100.0	9.9	10.2	14.5
	Canada : textiles			
United States	54.2	0.0		
European Union	8.7	9.4		
China	7.4	13.5	5.9***	
Korea, Rep.	4.4	10.3		
India	3.6	10.9	0.1	
ALL	100.0	5.2	0.5	0.0
	Canada : clothing			
China	27.4	15.6	30.4***	
United States	12.0	0.0		
European Union	8.0	16.3		
India	7.8	17.7		
Hong Kong	6.4	17.9		
ALL	100.0	14.5	11.6	0.1

***,** denotes estimated bilateral ETEs significant at the .01 level, and .05 level respectively.

Table 5
Cumulative Growth in percent: 1994-2004

	quota growth				GDP growth	
	textiles		clothing			
	US	EU	US	EU	per-capita	in total
importer						
United States					49	66
European Union					55	61
exporter						
Bangladesh	168	.	168	.	26	53
China	33	50	41	38	151	171
Hong Kong	37	16	17	22	1	16
India	141	50	116	79	57	84
Indonesia	134	83	133	117	19	35
Korea, Rep.	37	70	12	38	34	44
Pakistan	139	79	150	119	30	63
Sri Lanka	134	204	132	204	43	56
Philippines	134	112	119	112	1	21
Thailand	127	116	123	116	-10	-1

Source: Martin (2004), Eurostat, IFS, and own calculations.

Table 6
Comparison of Estimates for ETEs, 2003
Values in % of delivered price

	importer			
	US		EU	
	textiles	clothing	textiles	clothing
Quotas for China				
Andriamanjara et al. (2004)	10	20	.	.
Elbehri (2004)		30 to 48	.	.
Martin (2004)	20	36	1	54
Francois and Woerz	7	48	14	19
Quotas for India				
Andriamanjara et al. (2004)	18	12	.	.
Elbehri (2004)		20 to 41	.	.
Mlachila and Yang (2004)	3	20	1	20
Francois and Woerz	3	10	2	.

Source: Andriamanjara et al. (2004), Mlachila and Yang (2004), and own calculations.

Table A-1
Canada: non-linear least squares estimates of ETEs for WTO/ATC exporters as % of (ETE inclusive) export price for textiles

supplier	1996	1997	1998	1999	2000	2001	2002	2003
Arab Emirates	22.78	13.57	8.68	5.48	2.53			6.37
	(10.53)	(11.92)	(11.04)	(9.53)	(8.59)			(7.35)
Bangladesh	2.15	0.50			0.10	0.10		0.10
	(3.95)	(3.96)			(2.87)	(1.76)		(0.53)
Bulgaria				0.50	1.38	2.25	2.25	
				(1.60)	(1.60)	(1.60)	(1.60)	
Cambodia	22.36	14.38	13.72	14.09	11.82	6.28		
	(10.05)	(11.24)	(10.24)	(9.31)	(8.96)	(8.99)		
China	5.93	1.86	0.30		0.10	0.10		
	(7.71)	(6.07)	(2.89)		(2.56)	(3.90)		
CostaRica	2.44	2.53	0.79	1.57	6.19	12.20	15.04	7.41
	(1.35)	(2.16)	(0.66)	(1.14)	(3.54)	(5.88)	(6.79)	(3.94)
Dom. Rep.	0.30	0.10	0.03			0.01		
	(0.44)	(0.44)	(0.44)			(0.44)		
Hungary	6.28	0.70		0.99	1.67	1.28	0.10	
	(3.84)	(2.72)		(1.29)	(1.45)	(1.47)	(0.56)	
India	0.04	0.02	0.01			0.01		
	(0.46)	(0.46)	(0.46)			(0.46)		
Jamaica	18.70	7.66	13.34	23.14	29.87	32.07	31.37	32.57
	(10.05)	(11.24)	(10.24)	(9.31)	(8.96)	(8.99)	(8.45)	(8.22)
Lebanon	34.55	9.58			1.96	1.96		
	(11.66)	(13.62)			(14.17)	(14.17)		
SriLanka	2.63	0.99	0.20			0.02		
	(2.92)	(2.94)	(2.95)			(2.95)		
Lesotho	37.85	16.32	4.49	0.40		0.30		
	(10.60)	(9.18)	(6.06)	(1.73)		(9.65)		
Morocco	6.89	1.28	2.53	6.63	10.71	13.27	14.24	14.38
	(7.69)	(2.90)	(5.42)	(9.13)	(10.39)	(10.81)	(10.61)	(9.41)
Malaysia	6.98	2.53	0.60			0.10		
	(6.28)	(6.43)	(6.49)			(6.51)		
Oman	23.55	6.19			1.28	1.28		
	(8.15)	(9.01)			(9.24)	(9.24)		
Pakistan	0.79	0.30	0.10			0.01		
	(1.70)	(1.70)	(1.71)			(1.70)		
Quatar		4.67	26.69	56.80	66.33	58.30	32.11	16.67
		(4.77)	(12.18)	(8.68)	(7.49)	(8.08)	(10.53)	(15.70)
Romania				0.10	0.30	0.70	1.48	2.44
				(0.96)	(1.19)	(1.58)	(2.34)	(3.74)
Singapore	3.47	1.38	0.40	0.00				
	(4.19)	(3.21)	(2.00)	(0.70)				
Slovakia			1.57	3.10	3.75	3.10	1.57	
			(2.60)	(2.39)	(2.14)	(1.83)	(1.41)	
Swaziland		21.63	33.86	38.39	36.39	28.42	15.18	
		(9.38)	(9.87)	(10.20)	(10.26)	(9.80)	(8.53)	

t-ratios given in parentheses

Table A-2
Canada: non-linear least squares estimates of ETEs for WTO/ATC exporters as % of (ETE inclusive) export price for clothing

supplier	1996	1997	1998	1999	2000	2001	2002	2003
Brazil	30.17	8.09			1.67	1.67		
	(2.89)	(3.30)			(3.42)	(3.42)		
China	30.41	12.05	2.82			0.30		
	(3.26)	(3.65)	(3.84)			(3.89)		
Dom. Rep.	4.58	0.99			0.10			0.99
	(0.75)	(0.76)			(0.76)			(0.76)
Jamaica	28.98	26.31	37.69	41.18	30.75	8.68		45.21
	(2.50)	(2.75)	(2.55)	(2.44)	(2.53)	(2.40)		(2.56)
Morocco	46.89	40.83	49.11	56.82	58.32	52.52	40.86	32.61
	(2.77)	(2.93)	(2.73)	(2.54)	(2.51)	(2.65)	(2.90)	(2.89)
Poland	11.97	13.64	9.83	5.66	4.31	6.02	7.83	4.12
	(2.19)	(2.28)	(1.94)	(1.34)	(1.05)	(1.29)	(1.51)	(0.96)
Romania				2.82	8.59	14.97	18.10	12.13
				(3.26)	(3.14)	(3.00)	(2.88)	(2.70)
Slovakia		1.96		0.20	5.39	13.94	21.69	22.30
		(2.48)		(0.61)	(1.97)	(2.12)	(2.23)	(2.66)
Swaziland		98.33	56.43			7.75		
		(1.01)	(2.57)			(3.66)		
Turkey	18.10	6.80	1.57			0.20		
	(2.39)	(2.57)	(2.66)			(2.68)		
Uruguay	39.54	16.32	3.85			0.40		
	(3.22)	(3.78)	(4.06)			(4.14)		

t-ratios given in parentheses

Table A-3
EU15: non-linear least squares estimates of ETEs for WTO/ATC exporters as % of (ETE inclusive) export price for textiles

supplier	1996	1997	1998	1999	2000	2001	2002	2003
Argentina	6.98		0.60	3.10	4.12	2.72	0.10	
	(10.71)		(4.69)	(7.60)	(7.91)	(7.38)	(0.96)	
Brazil	5.03	9.01	7.41	4.58	3.01	3.29	3.57	0.20
	(6.98)	(9.40)	(9.18)	(7.80)	(6.38)	(6.87)	(7.65)	(0.73)
China	18.57	17.42	14.09	11.50	11.11	12.59	14.02	13.40
	(11.10)	(11.70)	(11.54)	(11.05)	(11.01)	(11.49)	(11.90)	(12.82)
HongKong	6.54	8.34	6.02	2.91	0.79	0.40	0.89	
	(6.45)	(7.80)	(7.51)	(5.39)	(1.93)	(1.07)	(2.73)	
Indonesia	2.15	2.91	3.29	3.01	2.15	0.99	0.03	
	(2.69)	(4.28)	(4.47)	(4.11)	(3.66)	(3.03)	(0.30)	
India	6.63	7.41	5.21	2.82	1.57	1.67	2.06	
	(8.63)	(9.01)	(8.23)	(6.18)	(4.11)	(4.51)	(6.22)	
Korea, Rep.	10.79	10.87	10.23	9.67	9.34	9.01	7.92	4.80
	(8.41)	(9.06)	(9.03)	(8.96)	(9.19)	(9.61)	(9.59)	(7.37)
Sri Lanka	5.57	3.01	2.63	2.72	2.34	1.19		
	(5.98)	(5.52)	(4.62)	(4.30)	(4.24)	(4.27)		
Malaysia	9.58	9.42	7.06	5.66	6.54	9.01	10.39	6.70
	(7.63)	(7.93)	(7.31)	(6.86)	(7.64)	(8.79)	(9.18)	(8.07)
Pakistan	13.12	12.51	9.09	5.66	3.75	3.38	3.19	0.01
	(10.30)	(10.20)	(9.72)	(8.49)	(7.08)	(6.98)	(7.87)	(0.30)
Peru	9.26	3.66	4.12	6.45	8.00	7.66	5.75	4.40
	(10.21)	(6.59)	(7.38)	(9.54)	(10.42)	(10.50)	(9.87)	(9.13)
Philippines	0.89	0.20			0.04	0.04		
	(1.16)	(1.17)			(1.17)	(1.17)		
Singapore	11.97	13.12	11.27	8.34	5.75	4.58	4.94	6.90
	(8.17)	(8.65)	(8.87)	(8.75)	(8.04)	(7.14)	(7.02)	(8.26)
Thailand	5.66	4.49	2.53	1.77	2.63	4.40	4.85	0.30
	(6.73)	(5.91)	(4.11)	(3.18)	(4.54)	(6.41)	(7.09)	(0.88)

t-ratios given in parentheses

Table A-4
EU15: non-linear least squares estimates of ETEs for WTO/ATC exporters as % of (ETE inclusive) export price for clothing

supplier	1996	1997	1998	1999	2000	2001	2002	2003
Brazil	24.76	6.10			0.60			6.10
	(2.91)	(3.25)			(3.35)			(3.25)
China	48.51	40.41	29.53	20.06	15.40	16.18	19.35	19.42
	(2.72)	(2.95)	(3.13)	(3.17)	(3.15)	(3.27)	(3.36)	(3.25)
HongKong	5.30	1.77	0.30		0.10	0.10		
	(1.67)	(1.44)	(0.98)		(0.94)	(1.82)		
Indonesia	9.17	3.10	0.50		0.30	0.79	1.19	1.96
	(2.56)	(1.75)	(0.91)		(2.10)	(1.00)	(0.84)	(1.47)
India	19.29	11.89	6.28	2.63	0.70			
	(3.36)	(3.20)	(2.96)	(2.70)	(2.45)			
Korea, Rep.	42.00	34.34	27.95	23.72	21.88	21.69	21.69	19.48
	(2.85)	(3.03)	(3.12)	(3.15)	(3.17)	(3.19)	(3.19)	(3.11)
SriLanka	26.25	15.40	5.30	0.20	1.67	7.41	12.36	9.34
	(2.91)	(3.01)	(2.77)	(0.36)	(1.93)	(2.92)	(2.98)	(2.88)
Peru	20.82	20.13	16.04	10.23	5.21	4.40	11.74	28.88
	(3.12)	(3.34)	(3.30)	(2.99)	(2.28)	(2.15)	(3.00)	(2.94)
Philippines	29.03	29.18	25.43	21.57	19.87	20.51	21.45	18.43
	(3.03)	(3.11)	(3.13)	(3.12)	(3.15)	(3.24)	(3.32)	(3.27)
Singapore	14.97	1.86	0.60	3.29	4.76	3.19		
	(2.82)	(1.97)	(0.66)	(1.99)	(2.36)	(2.52)		
Thailand	32.66	27.11	20.70	16.11	14.38	14.53	13.49	5.66
	(3.02)	(3.15)	(3.17)	(3.12)	(3.13)	(3.24)	(3.34)	(2.66)

t-ratios given in parentheses

Table A-5
USA: non-linear least squares estimates of ETEs for WTO/ATC exporters as % of (ETE inclusive) export price for textiles

supplier	1996	1997	1998	1999	2000	2001	2002	2003	2004
Bangladesh	0.30	0.79	2.25	3.57	3.38				
	(7.53)	(7.52)	(7.46)	(7.41)	(7.41)				
Brazil	6.19	9.58	8.84	6.19	3.19	0.99	0.01	0.01	
	(13.56)	(13.16)	(12.91)	(12.62)	(11.99)	(10.51)	(0.49)	(0.30)	
Cambodia	52.72	18.43	1.19	4.31	6.54	4.49			
	(9.35)	(12.24)	(16.81)	(12.39)	(12.36)	(12.55)			
China	6.45	4.12	4.40	5.39	5.93	6.19	7.24	11.11	20.19
	(12.10)	(10.39)	(12.39)	(14.55)	(15.57)	(16.26)	(16.67)	(15.51)	(13.23)
Colombia	14.46	4.49	0.05	0.10	3.29	7.92	12.66	16.32	18.23
	(5.51)	(5.87)	(0.36)	(0.46)	(3.67)	(4.69)	(5.31)	(6.03)	(6.89)
Czech Rep.	0.99	2.53	4.49	6.72	9.67	13.72	19.35		
	(1.98)	(2.26)	(2.77)	(3.80)	(6.03)	(10.36)	(11.83)		
Hungary	3.57	7.49	10.15	11.43	12.36	14.89	22.00		
	(6.20)	(5.95)	(5.85)	(6.14)	(7.45)	(10.91)	(12.40)		
Indonesia	0.10	0.70	2.06	3.38	4.21	4.49	4.76	5.84	9.17
	(0.58)	(1.64)	(3.57)	(5.09)	(6.45)	(7.65)	(8.25)	(8.43)	(7.37)
India	3.75	4.31	3.85	3.01	2.06	1.57	1.77	3.01	5.48
	(9.95)	(11.34)	(11.08)	(9.72)	(7.51)	(5.70)	(6.16)	(9.60)	(11.57)
Jamaica	0.30	0.60	2.53	5.30	7.41	6.80			
	(1.68)	(1.24)	(1.98)	(2.44)	(2.76)	(3.01)			
Korea, Rep.	0.50	0.89	0.79	0.30	0.89	4.31			
	(2.37)	(2.22)	(1.95)	(1.37)	(8.28)	(4.69)			
Malaysia	0.03	0.02	0.20	0.79	2.44	5.48			
	(1.87)	(0.70)	(2.03)	(3.43)	(4.68)	(5.68)			
Pakistan	5.21	1.57	0.30	0.03	0.60	2.82			
	(8.55)	(9.00)	(9.65)	(5.92)	(7.54)	(7.57)			
Poland	0.03	5.84	8.34	9.34	9.99	11.11	13.12	16.18	19.94
	(0.30)	(4.66)	(5.48)	(6.50)	(7.34)	(7.70)	(8.20)	(10.08)	(12.24)
Romania	4.67	2.25	0.30	1.86	5.48	9.58	12.51	11.89	
	(6.85)	(4.66)	(1.69)	(11.59)	(9.96)	(9.89)	(11.83)	(19.60)	
Slovakia	0.10	12.36	18.70	21.01	20.89	19.74	19.61	22.78	31.18
	(0.62)	(7.61)	(8.62)	(9.24)	(9.23)	(8.62)	(8.22)	(9.38)	(11.54)
Thailand	0.03	0.03	0.10	0.60	1.57				
	(2.10)	(2.10)	(2.10)	(2.10)	(2.09)				
Turkey	0.01	0.01	0.05	0.20	0.50				
	(1.06)	(1.06)	(1.06)	(1.06)	(1.06)				
Uruguay	2.15	4.12	4.94	5.21	6.98	13.19	26.90		
	(4.99)	(4.58)	(4.22)	(4.28)	(5.63)	(8.09)	(8.72)		

t-ratios given in parentheses

Table A-6
USA: non-linear least squares estimates of ETEs for WTO/ATC exporters as % of (ETE inclusive) export price for clothing

supplier	1996	1997	1998	1999	2000	2001	2002	2003	2004
Bulgaria			0.40	0.30	0.06	0.70	4.12	12.74	28.06
			(1.52)	(1.19)	(0.52)	(0.83)	(2.13)	(3.24)	(3.49)
Brazil	3.38	0.10		0.60	0.60			2.91	11.66
	(2.43)	(0.60)		(5.05)	(4.67)			(4.22)	(3.97)
Cambodia	37.73	16.11	4.12			0.79	0.79		
	(3.17)	(3.67)	(3.93)			(4.00)	(4.00)		
China	43.31	42.36	36.99	31.55	29.68	32.98	40.19	48.08	53.01
	(2.99)	(3.00)	(3.13)	(3.26)	(3.30)	(3.22)	(3.04)	(2.85)	(2.74)
Colombia	0.89			0.20	0.20			0.89	3.57
	(0.71)			(0.71)	(0.71)			(0.71)	(0.70)
Czech Rep.	13.57	30.84	38.20	42.66	47.84	55.04	63.90	72.91	80.56
	(2.18)	(2.75)	(2.80)	(2.79)	(2.73)	(2.59)	(2.38)	(2.14)	(1.87)
Hungary	0.00	0.40	8.09	17.70	26.25	32.93	38.16	43.18	49.92
		(0.59)	(2.78)	(2.74)	(2.69)	(2.70)	(2.78)	(2.88)	(2.83)
India	16.60	8.51	3.10	0.40		1.67	5.12	10.31	17.01
	(3.72)	(3.31)	(2.74)	(1.39)		(2.78)	(2.97)	(3.29)	(3.69)
Poland	21.20	46.44	52.79	54.07	55.44	58.40	61.48	60.92	48.93
	(2.69)	(2.72)	(2.58)	(2.53)	(2.47)	(2.41)	(2.37)	(2.45)	(2.81)
Romania	3.57	3.94	11.66	22.30	33.02	42.50	50.40	57.08	63.15
	(1.80)	(1.86)	(3.23)	(3.20)	(2.99)	(2.81)	(2.66)	(2.55)	(2.42)
Slovakia	0.00			5.57	17.76	33.33	47.40	55.89	55.56
	0.00			(3.03)	(2.87)	(2.65)	(2.47)	(2.45)	(2.67)
Turkey	0.00	1.19	0.30		1.77	5.84	11.35	16.39	18.50
	0.00	(1.02)	(0.70)		(1.70)	(1.72)	(1.89)	(2.45)	(3.95)
Uruguay	50.67	63.33	56.35	42.59	32.71	33.91	41.11	40.16	
	(2.73)	(2.42)	(2.61)	(2.91)	(3.03)	(2.91)	(2.77)	(2.82)	

t-ratios given in parentheses